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EDITOR
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University of Toronto, Toronto

ASSOCIATE EDITORS
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Director of the Dominion Astrophysical Observatory, Victoria, B.C.
SIR FREDERIC STUPART
Director of the Meteorological Service of Canada, Toronto
R. MELDRUM STEWART
Director of the Dominion Observatory, Ottawa

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THE JOURNAL
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ROYAL ASTRONOMICAL SOCIETY
OF CANADA

VOL. XIX JUNE-JULY No. 4

SECOND GENERAL ASSEMBLY OF THE INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION, MADRID, SEPTEMBER 24 TO OCTOBER 10, 1924

Noel J. Ogilvie, D.L.S., M.E.I.C., Director of the Geodetic Survey of Canada and President of the National Committee of Canada of the International Geodetic and Geophysical Union, had the honour of representing Canada at the Second General Assembly of the Union, and although the Report of the Proceeding of the Meetings has not been received as yet from the General Secretary of the Union, Mr. Ogilvie has given the following brief account of the Assembly.

The object or purpose of the International Union is to promote the study of problems relating to the shape and physics of the earth; to initiate and organize the conduct of researches which depend on co-operation between different countries and provide for their scientific discussion and publication; to facilitate particular researches, such as the comparison of instruments and methods used in different countries.

The International Union is divided into sections corresponding to the National Committees of the different countries belonging to the Union. One hundred and seventy-two delegates, representing thirty-two countries, proceeded to take up the work of the Union, dividing into sections as follows: Geodesy, sixty-five; Seismology, fifteen; Meteorology, eighteen; Terrestrial Magnetism and Electricity, twenty-four; Physical Oceanography, twenty-eight; Volcanology, ten; and lastly, a new and important section, Scientific Hydrology.

The General Assembly, previous to dividing into these sections, was held in the palace of the Chamber of Deputies, and was opened by the King of Spain. The first part of this meeting was taken up by delegates who presented reports of the work accomplished in their respective countries, since the first meeting of the International Union at Rome in 1922. A large part of the remainder of the time was occupied in completing the organization started at the previous meeting at Rome. A number of scientific papers were read. Special committees were formed to report on improvements on instruments and methods of carrying out scientific work in the various countries belonging to the Union.

Three outstanding features of the Conference were:

FIRST, a committee was formed to carry out or establish a longitude net around the world by wireless, to be used in checking the size and figure of the earth. Mr. Ogilvie was made a member of this Committee.

The SECOND outstanding feature was the paper presented under the Section of Oceanography by Admiral Sir John Parry on The Gulf Stream. This paper was prepared by one of our distinguished Canadian Scientists, Dr. W. Bell Dawson, whose name is known in every country as an authority on tides and currents.

The THIRD outstanding feature was the discussion on the determining of distances between two points through the velocity of light.

At the final meeting reports of the various sections were adopted and a decision made as to the place of meeting for the third Conference.

The invitation of the Czecho Slovakian Republic to hold the third Conference of the Union at Prague in September, 1927, was accepted.

The delegates had the privilege of visiting a number of scientific institutions in Spain, and excursions were planned by the National Committee of Spain for the delegates to visit a number of places of interest in the south of Spain.

Canada has taken a prominent part in the work and organization of the Section of Geodesy of the International Union of Geodesy and Geophysics, and the accuracy as well as the extent of Canadian geodetic operations is highly respected by the delegates from the various countries forming the Union.

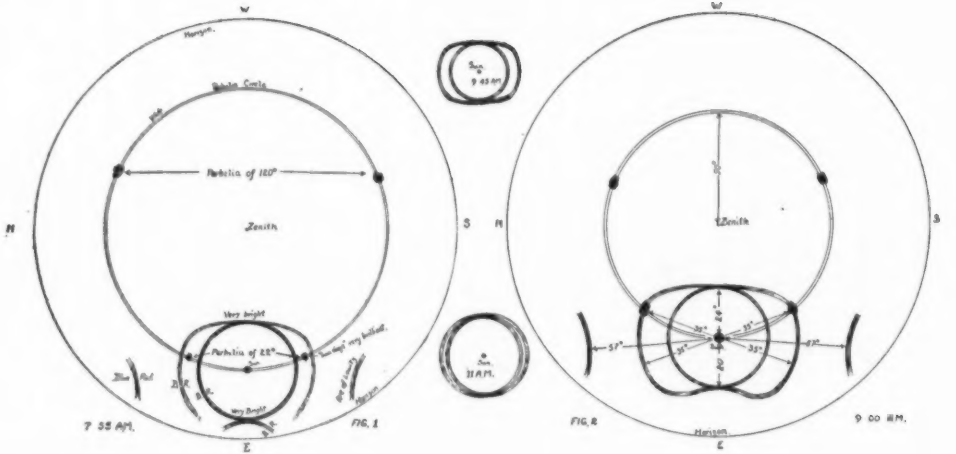
A REMARKABLE SOLAR HALO COMPLEX

By William H. Christie

DURING the morning of June 15, from 7.50 a.m. to 11.00 a.m. P.S.T., an extraordinarily fine example of a Solar Halo Complex was observed by the writer from Victoria, and the following brief account and description of it will probably be of interest to the readers of this Journal.

This spectacle was first seen by the writer about 7.50 a.m., but Mr. Plaskett tells me that it was seen by him at 7.30. When first seen the sky was uniformly misty white, due to the diffuse cirro-stratus clouds with which these phenomena are associated. The altitude of the Sun at this time was about 30° and around it was a brilliant halo of the usual radius of 22°. Above and below the Sun, were the tangent arcs, very brilliant at the point of tangency. Passing through the Sun, with the zenith as its pole, was the Parhelic Circle, a small circle of about 60° radius, of a uniform silvery white, and on this circle; about midway between the 22° circle and the upper tangent arc, were two brilliant mock suns. The predominating colour of these "Sun Dogs" was blue, although the whole of the spectrum was visible. They reminded one strongly of the appearance of a star of low altitude when seen through a telescope using a very high power. To the west, on the white circle, were two other bright spots, though these were colourless like the circle on which they were situated. These are known as the Parhelia of 120°, being 120° from the Sun. To the S.E. and N.W. were the "Arcs of Lowitz", so called after the astronomer who first described them. These various arcs were hurriedly sketched on a scrap of paper while the writer was waiting for a street-car (Fig. 1).

On arriving at the Observatory a more careful and accurate drawing of the phenomena was made (Fig. 2). It will be seen that the upper and lower tangent arcs are united. This was at first thought to be an optical illusion, but was drawn as seen. Later on looking up these phenomena in Humphrey's "Physics of the Air",


W
Horizon.
Parhelic Circle
Parhelia of 120°
Zenith
N
S
Very bright
Parhelia of 22°
Very bright
Very bright
E
7 55 AM.
FIG. 1
9 45 AM.
11 AM.
W
Zenith
N
S
E
Horizon
9 00 AM.
FIG. 2

it was seen that this is what might be expected. The changes observed in the shape of the tangent arcs with the varying altitude of the Sun are shown in the accompanying diagrams. It will be noticed that the "Sun Dogs" now appear at the intersection of the parhelic circle and the upper tangent arc: it was first thought by the writer that a mistake had been made in placing these as shown in the first drawing, but later evidence obtained from the afore-mentioned book seems to show that no error was made.

When the second drawing was made, the writer measured the angular distances between the various parts of this complex with the aid of a large protractor and a straight-edge. Of course great accuracy is not to be obtained by this method as no support for the protractor and straight-edge other than the observer's hand was used. Nevertheless this aided considerably in obtaining the relative positions of the various arcs, circles and parhelia, with some accuracy, the actual measures as made by the writer being given in the figure. It will be noticed that in the case of the circle of 22°, the Sun is eccentric according to the measures given, for the distance from the Sun to the upper point of tangency is 24°, while the distance to the lower point of tangency is only 20°. As the writer is describing exactly what was observed and measured no "adjustments" are made to any of the above figures and statements.

Dominion Astrophysical Observatory,
Victoria, B.C.
June 16, 1925.

WIRELESS TIME SIGNALS OBSERVED AT OTTAWA

By R. Meldrum Stewart

Bulletin No. 7

FOR convenience of reference the explanations and remarks given in previous bulletins are here collected and revised.

The signals were observed by the method of coincidences by extinction, in which the points of a relay operated by an auxiliary chronometer with a differential rate are inserted in the primary circuit of the receiving set. The reception of signals and the computations incident thereto have in the main been performed by Mr. J. P. Henderson, and occasionally by Messrs. Dier, Smith and Stewart. The adoption of clock corrections and their application have been carried out by the writer.

The time observations are made with a six-inch meridian circle, with registering micrometer and reversing eye-piece; collimation and level are measured usually several times on each observing day; azimuth is determined from star-observations, smoothed by combination with underground meridian marks. Up to the end of 1923 the star positions used were those of Boss; from the beginning of 1924 Eichelberger's positions have been adopted. This introduces a discontinuity of approximately .05 sec.; the net effect is to make Ottawa time slower than previously by this amount.

The first two columns of the Ottawa-Washington section give the observed corrections to the Annapolis signals as actually received; in the next two columns these quantities have been corrected for the errors of the Washington clock and for the lag of Annapolis, as given in the monthly lists distributed by the U.S. Naval Observatory.

For the Lafayette signals the times of the first and last beats (in Greenwich sidereal time) have been computed from the mean of the observed coincidences; the adopted rate of the transmitting clock has been deduced in some cases from the intervals between

corresponding signals on consecutive days, in others from the signals on the current day.

The second last column gives the observed clock-corrections reduced to 10 p.m. (3h G.C.T. of the following date). The adopted values in the last column have been derived from a smoothed curve, account being taken of daily comparisons of the two Riefler clocks.

The Honolulu signals were controlled by a chronometer beating seconds, and omitting one beat per minute, rated to gain approximately one second in fifty on mean time. In most cases the series of signals were not the theoretically ideal series, covering five complete "minutes" of the transmitting clock. The times given are those corresponding to the 150th beat of an ideal series; that is, they correspond in every case to the beat midway between two consecutive omissions, irrespective of whether the series was complete or not. For comparison with other observations these results may be reduced to refer to any other chosen beat by the use of the sidereal intervals given in the last column, which are correct to within about one unit in the last place. For reference there are also given the observed errors of the ordinary signals immediately preceding, which however are quite erratic. Observation of the Honolulu signals was discontinued on March 31 owing to increasingly bad receiving conditions incident on the approach of the summer season.

The adopted longitude of Ottawa is 5h 2m 51.940s; no correction has been made for time of transmission of the signals.

In Bulletin No. 4 results were given of an investigation of the systematic error of reception of Annapolis signals by the method of coincidences by extinction. The method there described is applicable in principle to any double-wave station, but difficulty had been experienced in applying it to Lafayette on account of the shortness of the signals. By a slight modification, however, this difficulty was largely overcome, and a series of measures was made by the observers H and S on various dates between November 17, 1923, and February 10, 1924. The differences between front and back wave tuning, which are double the systematic errors of reception, were as follows:

H $+^{s}.0013 \pm ^{s}.0004$ (46 measures)
S $+ .011 \pm .001$ (37 measures).

The positive sign indicates that, for normal reception, the signals are observed too late.

Another investigation of errors of reception was made by simultaneous observations of the same series of signals on two completely independent receiving units connected to different aerials. The same two observers as above took part in this, as well as a third observer D_1; the observations extended from May 27 to June 26, comprising 42 sets of signals from Annapolis. There emerged fairly definitely a small personal difference, as well as a curious systematic difference between the receiving units. There was, however, a certain amount of inductive interference between the units which was troublesome at times and may have had some effect. The results were as follows:

Difference of units $^{s}.006 \pm ^{s}.001$
$H - S \; +.004 \pm .002$
$H - D_1 \; -.015 \pm .002$

while the indicated probable error of reception of a single complete series of signals was $\pm .008$ sec. A positive sign indicates that the signals were observed later by the observer first named.

It will be noted that the difference H - S in the last investigation is of opposite sign to that found above and in Bulletin No. 4. It is obvious, however, that errors of this order of magnitude are totally inadequate to explain the differences found between the results of different observatories.

Dominion Observatory,
Ottawa, April, 1925.

1924 Date	Ottawa-Washington				Lafayette (G. Sid. T.)		ΔT at 10 p.m.	
	Observed		Corrected		1st beat	300th beat	Obsd.	Adopted
	Noon	10 p.m.	Noon	10 p.m.				
	s	s	s	s	h m s	h m s	s	s
Jan. 1	+.11	+.06		−.05	2 45 40.81	2 50 34.06		+18.258
2	+.06	+.02	−.08	−.07	3 1 9.29	3 6 2.55		+18.493
3	+.02	.00	−.07	−.08	2 57 0.73	1 53.99	+18.720	+18.738
4	+.06	+.05	−.05	−.05	57 47.11	2 40.36		+18.998
5	+.07	+.06	−.04	−.04	3 1 28.79	6 22.04		+19.274
6	+.06	+.08	−.04	−.02	6 10.35	11 3.61		+19.549
7	+.08	+.10	−.02	.00	7 55.37	12 48.62	+19.834	+19.819
8	+.10	+.09	−.01	+.02				+20.077
9	+.09	+.07	+.04	+.03	19 14.81	24 8.06		+20.324
10	+.09	+.11	+.03	+.04	20 59.23	25 52.48		+20.570
11	+.10	+.12	+.03	+.04	25 40.58	30 33.84		+20.827
12	+.10	+.12	+.03	+.05	31 21.00	36 14.24		+21.080
13	+.10	+.11	+.03	+.03	33 5.63	37 58.88		+21.335
14	+.06	+.09	+.01	+.03	37 46.47	42 39.72		+21.591
15	+.10	+.06	+.03	+.02	43 26.80	48 20.05		+21.843
16	+.10	+.02	+.09	+.01	45 11.96	50 5.21		+22.093
17	+.10	+.08	+.01	.00	49 53.75	54 47.00		+22.351
18	+.11	+.09	+.02	+.01	53 36.24	58 29.49		+22.616
19	+.09	+.07	.00	−.01	58 17.33	4 3 10.58		+22.872
20	+.06	+.07	−.03	−.02	4 2 58.82	7 52.08		+23.129
21	+.11	+.08	−.02	−.04	4 44.01	9 37.27		+23.394
22	+.02	+.01	−.04	−.04	9 24.39	14 17.64		+23.662
23	+.02	+.02	−.03	−.03	15 3.24	19 56.49	+23.922	+23.923
24	+.06	+.09	−.02	.00	22 37.31	27 30.57		+24.185
25	+.11	+.06	+.01	−.01	20 28.17	25 21.43		+24.444
26	+.05	+.06	−.02	−.03	22 14.18	27 7.44		+24.701
27	+.03	−.01	−.04	−.09	26 56.75	31 49.99		+24.957
28	−.01	−.03	−.06	−.06	28 41.28	33 34.53		+25.213
29	+.01		−.06		35 19.61	40 12.86		+25.474
30	+.08	+.07	+.01	+.02	38 3.07	42 56.32		+25.754
31	+.09	+.08	+.01	+.01	43 43.11	48 36.35	+26.022	+26.029
Feb. 1	+.08	+.10	.00	+.01	4 48 24.14	4 53 17.40		+26.318
2	+.12	+.09	+.01	−.01	54 4.21	58 57.46		+26.603
3	+.11	+.09	−.01	−.03	53 51.06	58 44.32		+26.890
4	+.06	+.07	−.03	−.02	59 30.93	5 4 24.19		+27.182
5	+.04	+.06	−.02	−.01	5 2 13.94	7 7.19		+27.459
6	+.04	+.06	−.03	−.02	8 52.43	13 45.68		+27.742
7	+.07	+.07	−.01	−.01	8 39.05	13 32.30	+28.029	+28.031
8	+.05	+.06	−.02	−.02	14 18.56	19 11.81	+28.329	+28.312
9	+.06	+.09	−.03	−.02	20 56.67	25 49.92	+28.592	+28.599
10	+.07	+.09	−.02	−.01	22 39.79	27 33.02		+28.876
11	+.08	+.10	−.03	.00	27 19.05	32 12.30	+29.190	+29.176
12	+.10	+.09	.00	−.01	29 2.51	33 55.76	+29.456	+29.469
13	+.06	+.09	−.02	.00	37 37.63	42 30.88	+29.761	+29.768
14	+.05	+.06	−.01	.00	47 12.15	52 5.40		+30.067
15	+.07		+.02		53 50.83	58 44.08	+30.383	+30.374

1924 Date	Ottawa—Washington				Lafayette (G. Sid. T.)		ΔT at 10 p.m.	
	Observed		Corrected					
	Noon	10 p.m.	Noon	10 p.m.	1st beat	300th beat	Obsd.	Adopted
	s	s	s	s	h m s	h m s	s	s
16	+.11	+.09	+.02	+.02			+30.654	+30.675
17	+.09	+.10	+.02	+.04	5 52 24.42	5 57 17.67		+30.983
18	+.08	+.10	+.01	+.03	6 2 57.67	6 7 50.92	+31.305	+31.291
19	+.07	+.08	+.01	+.02	5 58 47.72	3 40.97		+31.601
20	+.08	+.09	+.01	+.01	6 3 27.72	8 20.96		+31.897
21	+.11	+.11	+.01	.00	9 6.79	14 0.03		+32.202
22	+.11	+.12	.00	−.01	11 49.35	16 42.60	+32.488	+32.509
23	+.16	+.15	+.01	.00	13 33.19	18 26.43	+32.849	+32.828
24	+.15	+.09	−.01	.00	22 9.27	27 2.52	+33.160	+33.154
25	+.08	+.06	−.01	−.01	39 34.35	44 27.60	+33.455	+33.483
26	+.09	+.09	−.02	−.01	26 35.36	31 28.62	+33.809	+33.808
27	+.06	+.07	−.04	−.03	30 16.82	35 10.08		+34.159
28	+.07	+.08	−.05	−.04	35 55.58	40 48.85	+34.502	+34.510
29	+.03	+.05	−.05	−.04	44 30.80	49 24.04	+34.852	+34.865
Mar. 1	+.06	+.13	−.01	+.06	6 43 17.31	6 48 10.55		+35.240
2	+.07	+.10	−.02	+.02	45 59.72	50 52.97		+35.622
3	+.13	+.15	+.02	+.04	52 37.87	57 31.11		+36.011
4	+.07	+.09	+.02	+.05	7 4 10.24	7 9 3.49		+36.405
5	+.08	+.09	+.03	+.06	6 58 3.55	2 56.80		+36.795
6	+.09	+.08	+.06	+.06	7 3 43.27	8 36.52		+37.191
7	+.13	+.14	+.07	+.09	5 27.62	10 20.88		+37.590
8		+.16		+.11	17 0.05	21 53.30		+37.996
9	+.16	+.15	+.10	+.11	17 44.78	22 38.03		+38.411
10	+.17	+.18	+.08	+.12	24 22.46	29 15.71		+38.818
11					23 9.83	28 3.07		+39.229
12		+.13		+.07	26 50.56	31 43.80	+39.661	+39.637
13	+.09	+.10	.00	−.03	31 30.04	36 23.29	+40.001	+40.049
14	+.06	+.41	−.05	−.05	39 5.06	43 58.30		+40.479
15	+.05	+.03	−.03				+40.933	+40.922
16	+.04	+.05	−.04	−.03	42 27.50	47 20.75		+41.373
17		+.02		−.03	46 7.17	51 0.41	+41.815	+41.824
18	−.01	+.02	−.05	−.03	51 45.29	56 38.53		+42.262
19	+.02	+.03	−.04	−.03	55 25.27	8 0 18.52	+42.721	+42.700
20	+.02	+.02	−.03	−.03	8 14 47.71	19 40.95	+43.137	+43.141
21	+.04	+.01	.00	−.01	1 47.56	6 40.80		+43.578
22		+.02		−.01	5 26.88	10 20.12	+44.005	+44.025
23	+.06	+.07	−.02	−.02	29 41.99	34 35.23	+44.501	+44.473
24	+.07	+.06	−.04	−.04	15 42.77	20 36.02	+44.906	+44.915
25	+.04	+.05	−.05	−.05	17 24.26	22 17.50	+45.359	+45.368
26	+.06	+.05	−.06	−.06	22 4.43	26 57.68		+45.814
27	+.06	+.07	−.05	−.05	30 40.63	35 33.88		+46.272
28	+.02	+.03	−.05	−.04	28 29.55	33 22.80	+46.737	+46.738
29	+.06	+.01	−.02	−.02	34 9.14	39 2.39		+47.206
30	+.04	+.04	−.04		35 53.26	40 46.52		+47.665
31		+.06		−.02	43 30.09	48 23.34	+48.133	+48.127

1924 Date	Ottawa—Washington				Lafayette (G. Sid. T.)		ΔT at 10 p.m.	
	Observed		Corrected		1st beat	300th beat	Obsd.	Adopted
	Noon	10 p.m.	Noon	10 p.m.				
	s	s	s	s	h m s	h m s	s	s
Apl. 1	+.03	+.04	−.06	−.03	8 47 11.36	8 52 4.61		+0.660
2	+.05	+.05	−.05	−.02	49 53.43	54 46.69	+0.769	+0.765
3	+.04	+.07	−.03	−.02	55 31.68	9 0 24.93		+0.868
4	+.07	+.07	−.03	−.02	55 16.82	0 10.07		+0.968
5	+.05	+.10	−.04	.00	9 0 55.02	5 48.27	+1.066	+1.065
6	+.09	+.09	−.02	.00	9 29.10	14 22.34		+1.162
7	+.06	+.07	−.02	+.01	10 11.81	15 5.06		+1.258
8		+.05		.00	11 53.14	16 46.39		+1.354
9	+.09	+.11	−.01	+.01	17 29.30	22 22.53		+1.451
10	+.11	+.11	+.01	+.01	24 4.40	28 57.64		+1.547
11	+.10	+.11	−.01	.00	24 48.01	29 41.25	+1.643	+1.644
12	+.11	+.14	−.01	+.01	27 28.68	32 21.93		+1.750
13		+.05		−.01	33 6.27	37 59.51		+1.820
14	+.04	+.01	−.04	−.04	35 47.37	40 40.62	+1.948	+1.918
15	−.03	−.03	−.07	−.07	41 26.66	46 19.92	+1.972	+1.972
16		+.02		+.01			+1.902	+1.928
17	+.03	+.11	−.02	−.01	51 47.04	56 40.29		+1.979
18	+.08	+.10	−.05	−.02	10 3 19.11	10 8 12.36		+2.048
19	+.10	+.08	−.03	−.04	9 57 13.29	2 6.54	+2.123	+2.128
20	+.13	+.15	−.05	−.03	10 1 54.72	6 47.96		+2.206
21	+.05	+.03	−.05	−.04	10 31.93	15 25.18		+2.284
22	+.07	+.04	−.03	−.04	7 22.82	12 16.07		+2.357
23	+.08	+.08	−.04	−.03	10 6.49	14 59.74	+2.418	+2.410
24	+.07	+.06	−.04	−.03	16 24.61	21 17.86	+2.468	+2.476
25	+.05	+.01	−.02	−.05	30 55.19	35 48.44	+2.528	+2.534
26	+.02	.00	−.05	−.03	23 51.02	28 44.27	+2.640	+2.598
27	+.02	+.02	−.04	−.03	33 25.94	38 19.19	+2.605	+2.656
28	+.02	.00	−.01	−.02	32 13.03	37 6.28	+2.740	+2.725
29					36 53.56	41 46.81		+2.781
30	+.18*		+.01		40 33.99	45 27.24		+2.852
May 1	+.15*	+.07	−.01	+.02	10 44 13.04	10 49 6.29	+2.900	+2.891
2	+.05	+.10	−.03	.00	45 56.90	50 50.15	+2.930	+2.945
3	+.12	+.13	+.03	+.04	52 35.87	57 29.11		+2.977
4	+.13	+.16	+.03	+.05	53 19.53	58 12.76		+3.025
5	+.15	+.14	+.03	+.04	58 59.15	11 3 52.41	+3.062	+3.041
6	+.12	+.11	+.05	+.03	11 7 35.18	12 28.44	+3.045	+3.058
7	+.10	+.07	+.02	+.01	8 19.12	13 12.38		+3.058
8	+.16*	+.07	.00	.00	21 47.98	26 41.23		+3.073
9	+.02	+.02	−.03	.00	27 26.95	32 20.20		+3.095
10	+.02	+.04	−.04	−.02				+3.114
11	+.02	+.02	−.03	−.01	23 6.08	27 59.33		+3.126
12	+.04	+.04	−.03	−.02	28 46.71	33 39.97		+3.156
13	+.03	+.04	−.05	−.04	41 19.44	46 12.69		+3.191
14	+.04	+.03	−.02	−.02	35 13.94	40 7.19		+3.206
15	+.02	.00	−.01	−.02	39 55.78	44 49.03		+3.227
16	+.03	−.01	+.02	−.02	41 41.37	46 34.63	+3.219	+3.212

*Signals sent by Sayville.

1924 Date	Ottawa—Washington				Lafayette (G. Sid. T.)		ΔT at 10 p.m.	
	Observed		Corrected		1st beat	300th beat	Obsd.	Adopted
	Noon	10 p.m.	Noon	10 p.m.				
	s	s	s	s	h m s	h m s	s	s
May 17	+.07	+.08	−.05	−.02	11 47 22.24	11 52 15.49		+3.195
18	+.06	+.07	−.05	−.04	50 6.60	54 59.85	+3.166	+3.136
19	+.02	+.04	−.03	−.01	53 12.21	58 5.46	+2.995	+2.999
20	+.05	+.06	+.03	+.04			+2.858	+2.871
21	+.11	+.07	+.08	+.05	12 2 52.49	12 7 45.74		+2.794
22	+.09		+.02		4 42.19	9 35.44	+2.729	+2.731
23	+.11	+.09	+.03	+.03	8 29.21	13 22.47		+2.691
24	+.05		+.01		15 12.42	20 5.68		+2.686
25	+.08	+.08	−.01	.00	21 55.37	26 48.62		+2.634
26	+.09	+.05	+.01	.00	21 46.42	26 39.67		+2.583
27	+.07	+.11	−.02	+.03	34 22.19	39 15.45		+2.499
28	+.11	+.12	.00	+.03	31 15.61	36 8.86	+2.458	+2.441
29	+.09	+.06	−.05		35 59.55	40 52.80	+2.348	+2.404
30	+.07	+.09	−.04	−.02	38 46.09	43 39.35	+2.396	+2.367
31	+.07	+.08	−.02		45 28.17	50 21.44		+2.312
June 1	+.04	+.07	−.02	.00	12 45 18.42	12 50 11.72		+2.277
2	+.05	+.07	−.04	−.02	49 4.23	53 57.48		+2.222
3	+.08	+.07	−.01	−.03	53 49.02	58 42.28	+2.161	+2.156
4	+.06	+.06	−.05	−.03	13 0 31.01	13 5 24.26	+2.121	+2.073
5	+.06	+.13	−.05	+.02	12 7.56	17 0.82	+1.891	+1.865
6	+.05	+.08	−.02	+.01			+1.584	+1.585
7	+.06	+.02	+.01	−.04				+1.340
8	+.05	+.09	−.04	−.01	15 33.69	20 26.95	+1.049	+1.050
9	+.10	+.10	+.01	.00			+0.773	+0.774
10	+.11*	+.13	−.07	+.02			+0.509	+0.528
11	+.11	+.09	+.01	−.01				+0.340
12	+.10	+.11	.00	+.02	30 36.90	35 30.15		+0.132
13	+.13	+.15	+.04	+.08	36 20.01	41 13.24	−0.092	−0.089
14	+.13	+.16	+.04	+.07			−0.273	−0.293
15	+.10	+.13	+.03	+.05	43 50.81	48 44.04		−0.504
16	+.15	+.13	+.06	+.06			−0.731	−0.710
17	+.15	+.17	+.03	+.02				−0.898
18	+.09	+.08	+.01	−.02			−1.058	−1.056
19	+.08	+.07	−.03	−.05	56 55.38	14 1 48.64	−1.216	−1.207
20	+.10	+.08	+.02	+.01	14 3 37.77	8 31.03		−1.367
21	+.09	+.07	+.01		13 16.59	18 9.85	−1.524	−1.524
22	+.13	+.06	+.04	+.03				−1.659
23	+.12	+.09	+.05	+.03	13 56.27	18 49.53	−1.788	−1.799
24	+.10	+.06	+.03	+.02	16 43.33	21 36.59		−1.925
25	+.05	+.05	+.01	+.02			−2.097	−2.092
26	+.12	+.12	+.06		24 15.19	29 8.45	−2.262	−2.270
27	+.09	+.17	.00	+.06	29 48.72	34 41.98	−2.455	−2.465
28	+.11	+.14	+.02	+.04	38 30.69	43 23.95		−2.645
29	+.15	+.08		+.01				−2.815
30	+.04	+.07		−.01	52 54.43	57 47.69		−2.998

*Signals sent by Sayville.

HONOLULU TIME SIGNALS

1924 Date	Ordinary 7 a.m.	Ordinary 7 p.m.	Scientific (G. Sid. T.) 7 a.m.	Scientific (G. Sid. T.) 7 p.m.	Sidereal Interval
	s	s	h m s	h m s	s
Jan. 1	− .55	− .39	18 43 13.38	6 44 26.42	.98259
2	− .50	− .52	46 38.29	48 50.35	
3	− .45	− .14	51 2.23	52 15.35	
4		+ .01		56 39.41	
5	− .29	+ .34	58 51.43	7 1 3.57	
6	+ .93	+ .67	19 2 16.59	4 28.70	
7					
8	+1.12	+1.40	10 6.01	12 18.33	
9		+1.48	14 30.51	16 42.79	
10	+1.24	+ .85	17 55.83		
11	− .06		22 19.94		
12	+ .01	+ .41	25 45.19		
13	.00	+ .63	30 9.40	32 21.62	
14	+ .83		34 33.63		
15	− .33	+ .64	37 58.89	40 11.03	
16	+ .86	+1.13	42 23.03	43 36.23	
17	+1.48		45 48.32		
18	+1.94	+1.72	49 13.41	51 25.59	
19	+2.12		53 38.04	55 50 52	
20	− .11		58 2.61		
21	− .38		20 1 28.08		
22					
23		−1.28	9 17.67	8 11 29.87	
24	−1.69		13 42.06		
25			17 7.70		
26	− .41		21 32.22		
27	− .57	− .92	24 57.92	27 10.31	
28	−1.47	−1.32	29 22.53	30 35.99	
29			32 48.20		
30					
31		+ .92	41 37.43	42 50.87	.98259

HONOLULU TIME SIGNALS

1924 Date	Ordinary		Scientific (G. Sid. T.)		Sidereal Interval
	7 a.m.	7 p.m.	7 a.m.	7 p.m.	
	s	s	h m s	h m s	s
Feb. 3	+ .15		20 52 52.93	8 55 5.24	.98259
4	− .18		56 18.43		
5	− .25		21 0 42.61		
6			4 7.99		
7	− .74		9 31.34		
9	− .44		16 21.76		
10	− .49	− .30	20 45.89	9 22 58.00	
13	− .21				
16	− .80				
19	+ .08				
20		+ .54		10 2 1.98	
27				28 55.02	
28	— .28		22 31 6.96		.98259
Mar. 2		+ .32	44 19.29		.98258
3	+ .15	+ .32	47 44.36		
4	+ .17		51 9.36		
6			58 58.19		
7			23 2 23.09		
8		+ .13	6 46.94		
9	+ .73	+ .59			
10	+ .65		14 35.74		
11	+ .62		18 59.51		
13	+ .13	− .29	26 48.28		
14	− .16	− .02	30 13.29	11 32 25.38	
15	+ .05		34 37.32		
16	+ .48	+ .29	39 1.21		
17	+ .52		42 26.22		
18	+ .29				
20	+ .76		53 40.20		
22	+ .84		0 2 27.86		
23	+ .82		5 52.78		
30		+ .20		12 35 54.09	
31	+ .25		38 6.00		.98258

AGINCOURT AND MEANOOK MAGNETIC RESULTS FOR 1924

By W. E. W. Jackson

In the accompanying tables there is given a summary of the results obtained at Agincourt and Meanook Magnetic observatories during the year 1924.

The values of Declination (D), Horizontal Force (H) and Vertical Force (Z) for Agincourt and of Declination for Meanook are obtained from the mean hourly readings of the photographic records, based on absolute observations made each week for D and H and twice each week for Inclination. The mean monthly values of I for Agincourt are derived from the means of H and Z. The mean values of H and I for Meanook are from absolute observations made twice each month for H and weekly for I, and are uncorrected for diurnal variations, but are taken alternately in morning and afternoon so as to eliminate this variation. The value of Z for Meanook is derived from the mean H and mean I.

All observations are corrected to International Magnetic Standard.

Summary of Magnetic Results at Agincourt for 1924. Lat. 43° 47′ N.; Long. 79° 16′ W.

Agincourt Declination West

Month 1924	Mean of Month	Maximum	Date of Max.	Minimum	Date of Min.	Month Range	Mean Daily Range	
							From 24-hour Readings	From Means of Extremes
	° ′	° ′		° ′		° ′	′	′
January....	7 3.8	7 53.2	29	5 39.8	29	2 13.4	7.6	16.2
February...	7 4.1	7 15.7	5	6 50.7	10	0 25.0	5.4	11.0
March.....	7 4.4	7 15.2	29	6 44.4	7	0 30.8	8.6	14.4
April.....	7 4.9	7 19.0	26	6 52.8	24	0 26.2	8.9	12.6
May.....	7 5.0	7 49.0	22	6 28.8	21	1 20.2	10.9	17.9
June.....	7 5.7	7 30.4	10	6 38.2	19	0 52.2	11.9	18.2
July.....	7 5.8	7 18.6	21	6 53.6	26	0 25.0	12.6	16.2
August.....	7 6.1	7 18.6	1	6 54.2	5	0 24.4	13.7	16.6
September..	7 6.8	8 3.5	23	6 37.4	7	1 26.1	12.0	18.2
October....	7 7.2	7 25.1	23	6 42.9	24	0 42.2	8.9	14.2
November..	7 7.7	7 26.4	24	6 59.0	12	0 27.4	7.1	10.3
December..	7 7.6	7 15.7	21	6 48.3	20	0 27.4	5.6	9.1

Agincourt Horizontal Force

Month 1924	Mean of Month	Maximum	Date of Max.	Minimum	Date of Min.	Month Range	Mean Daily Range	
							From 24-hour Readings	From Means of Extremes
	γ	γ		γ		γ	γ	γ
January....	15760	15781	10	15599	29	182	10.2	27.4
February...	15761	15779	16	15736	8	43	10.6	20.3
March.....	15761	15787	21	15725	6	62	15.2	28.2
April.....	15763	15791	7	15720	26	71	20.3	30.7
May.....	15756	15870	22	15639	21	231	32.5	54.0
June.....	15755	15920	10	15577	10	343	36.2	63.8
July.....	15755	15803	9	15718	27	85	29.4	44.4
August.....	15753	15796	4	15705	29	91	30.2	42.0
September..	15739	15792	23	15494	23	298	28.1	47.7
October....	15742	15770	15	15660	24	110	30.2	46.2
November..	15736	15759	19	15670	23	88	23.1	32.6
December..	15740	15763	11	15718	21	45	14.0	21.0

Agincourt Vertical Force

Month 1924	Mean of Month	Maximum	Date of Max.	Minimum	Date of Min.	Month Range	Mean Daily Range	
							From 24-hour Readings	From Means of Extremes
	γ	γ		γ		γ	γ	γ
January....	57788	57835	29	57720	29	115	3.9	10.5
February...	57789	57820	5	57775	25	45	2.7	7.2
March.....	57769	57791	30	57743	30	48	6.4	14.3
April.....	57747	57776	7	57672	26	104	6.1	13.6
May.....	57725	57872	22	57524	22	348	16.8	38.2
June.....	57723	57857	10	57594	10	263	13.5	33.0
July.....	57730	57762	27	57676	21	86	8.9	20.4
August.....	57723	57753	29	57677	17	76	7.7	15.2
September..	57718	57795	7	57644	7	151	10.8	32.3
October....	57701	57783	23	57578	24	205	7.5	23.9
November..	57698	57721	25	57677	24	44	4.3	11.1
December..	57687	57707	11	57673	30	34	3.5	6.9

SUMMARY OF MAGNETIC RESULTS AT MEANOOK FOR 1924. LAT. 54° 37′ N.; LONG. 113° 20′ W.

Meanook Declination East

Month 1924	Mean of Month	Maximum	Date of Max.	Minimum	Date of Min.	Month Range	Mean Daily Range	
							From 24-hour Readings	From Means of Extremes
	° ′	° ′		° ′		° ′	′	′
January	27 21.8	28 10 2	29	25 57.5	29	2 12.7	5.2	22.6
February	27 22.0	27 50.7	5	26 58.8	16	0 51.9	4.9	18.0
March	27 20.4	27 59.4	20	26 41.2	3	1 18.2	7.6	22.7
April	27 19.7	29 1.7	26	26 49.6	25	2 12.1	9.8	23.7
May	27 18.1	30 4.6	22	26 13.5	22	3 51.1	13.6	28.1
June	27 16.6	30 5.0	10	26 3.7	10	4 1.3	17.2	29.9
July	27 16.8	28 19.8	21	26 57.8	15	1 22.0	14.5	23.1
August	27 16.9	27 54.8	31	27 0.0	17	0 54.8	14.0	20.4
September	27 16.1	27 56.4	7	25 59.9	23	1 56.5	11.6	27.4
October	27 15.0	28 59.1	24	26 4.9	23	2 54.2	8.7	23.1
November	27 14.1	28 14.6	24	26 35.6	24	1 39.0	6.0	16.4
December	27 14.6	27 34.3	23	26 52.7	11	0 41.6	4.4	14.0

MEAN MONTHLY VALUES OF I AT AGINCOURT AND MEANOOK AND OF H AND Zc AT MEANOOK FOR 1924.

Month 1824	Ag I	Me I	Me H	Me Z
	° ′	° ′	γ	γ
January	74 44.7	77 53.7	12873	60022
February	44.7	53.8	12867	60002
March	44.4	53.9	.....	.....
April	43.9	53.6	12865	59976
May	44.0	53.0	12878	59985
June	44.0	53.5	12867	59977
July	44.1	52.9	12868	59930
August	44.1	53.3	12866	59955
September	44.8	53.6	12860	59952
October	44.4	54.4	12856	60002
November	44.7	54.2	12858	59994
December	44.3	53.8	12873	60030

MEETINGS OF THE SOCIETY

At Toronto

In Toronto we have had a growing number of requests that Lectures on the elementary facts of Astronomy be given in Churches, Sunday Schools, Colleges, Clubs, Schools, etc., and in order to deal with the matter satisfactorily the Council appointed a Speakers' and Membership Committee at the beginning of the present year. The idea has been to request members in various parts of the city who are equipped to give an illustrated lecture, to undertake to accept invitations to speak in their locality. This plan, in operation for the latter part of the season, has so far resulted in about twenty lectures being given, at which invitations to join the Society have been distributed.

While this organized plan has not been in operation long enough for us to draw any conclusions, those who have taken part in it have found the people in a most receptive mood, and the lectures, as well as the excellent photographs of the heavens which the Society has been able to throw upon the screen, have been received with the greatest interest and enthusiasm. This work of taking astronomy to the people has been done by a very limited number of members of the Society for many years, and it is possible that a moderate enlargement of the idea might be beneficial from the standpoint of an increase in our membership, as well as in calling attention to the regular meetings of the Society. Other centres may find some value in this plan, which will probably be continued in greater measure during next season. F. T. S.

April 21, 1925.—The regular meeting of the Society was held in the Physics Building at 8 p.m., Mr. A. F. Hunter in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Hunter remarked that Saturn would be in opposition on the 1st of May and in a favourable position for observation.

The speaker of the evening was Mr. A. R. Hassard, his subject being "Observations for the coming summer". Mr. Hassard described several instruments which an amateur astronomer might find useful, ranging from a pair of opera glasses to an astronomical telescope. One should also have an observer's handbook, star maps and an almanac.

Many interesting observations may be made which require little technical knowledge of astronomy; by means of a thermometer and barometer changes in temperature and pressure may be recorded.

To observe the sun special instruments are necessary, but with these it is possible to see sunspots, the poles of the sun, and sometimes halos and sun-dogs.

Rainbows and double rainbows are often seen in the summer. The moon is the best subject for observation. With a small telescope one may see its craters and mountains and their shadows, also lines which look like cracks in the surface,

and occasionally streaks of light in the craters. It is interesting to follow the changes in the appearance of these marks on the surface as the moon passes through its various phases.

The aurora is sometimes visible on a clear cool night when there is no moon. Venus will not be visible at night but may be seen during the day if its position is known fairly closely. It may be possible to see Mercury for a few nights about the end of July.

Mars will not be in good position for observation. Jupiter and Saturn are in a favourable position for observation during July and August. With a small instrument one may see the rings of Saturn, the bands of Jupiter and possibly four of its moons.

The constellations may be found by means of the star maps.

In connection with double stars Mr. Hassard mentioned the double in Cygnus with its purple and yellow components, and the double double in Lyra, finally the Milky Way affords an endless source for study.

Mr. R. A. Gray then summarized the March Magazines. He mentioned the discovery announced by Prof. McLennan of a line—narrow, short, and well defined, of wave-length 5577.35—in the spectrum, using a mixture of oxygen and helium gases, the line is not found in pure oxygen, hydrogen, nitrogen or helium spectra.

Mr. Gray also mentioned an article which discussed meteoric and volcanic theories, to account for the craters on the surface of the moon, and the objection to these theories. The article offered some further suggestions for the meteoric theory.

The meeting adjourned at 10.15 p.m.

May 5, 1925.—The regular meeting of the Society was held in the Physics Building at 8 p.m., Mr. A. F. Hunter in the chair.

Mrs. N. R. Sissons of Barrie, Ont., was nominated for membership in the Society.

Mr. Hunter remarked that Mercury would be visible as a morning star about May 16. Mr. Miller reported some recent activity on the sun, there being a few spots of varying size but not many prominences.

Dr. Fraser brought up the question as to the correct day for registration of a birth or death occurring between the hours of 12 a.m. and 1 a.m. daylight saving time.

The Vice-President, Mr. A. F. Hunter, gave the first address of the evening, his subject being "Notes on the formation of Thunderstorms". The clouds which bring about the storms are formed by a rushing up of air, carrying water vapours which condense as they rise to colder parts and reach sometimes to a height of ten miles. Mr. Hunter compared a thunderstorm to a travelling volcano and demonstrated the analogy by means of slides. He also showed pictures of various kinds of lightning—the flashes generally proceeding from the clouds to the earth, but sometimes in the opposite direction. Various estimates of the voltage of a flash of lightning have been made, the latest by Dr. Peak, who found its influence

on a transmission line and hence calculated the voltage to be sometimes as high as a 100 million volts.

Very violent thunderstorms occur in South Africa, India and Western Canada. They often occur on the rainy side of a low depression and seem to develop when solar activity is greatest. It has been found by experiment that air and condensed vapour forced upward will produce electricity. It is possible that an electrical increase could precipitate rainfall artificially from the cloud which forms generally at the top of a hill.

Mr. Arthur Kennedy then addressed the meeting on "Hubble's measurements of the distances of spirals." Mr. Kennedy showed by means of slides the different types of nebulae, some being gaseous in character with a bright line spectrum and others having a continuous spectrum. The spiral nebulae belong to the latter class.

Dr. Hubble directed his attention to the spiral in Andromeda, the largest spiral in the heavens, and his theory is that it is a separate universe composed of millions of stars. By the Cepheid variable method, the distance of this nebula has been estimated to be nearly one million light years.

After some discussion the meeting was adjourned.

At Montreal

April 24, 1925.—Mr. Justice E. E. Howard in the chair. The minutes were taken as read. The following new members were elected: Professor E. T. Lambert, Mr. Clarence Lyman, and Mr. E. F. Walter.

The lecturer was Professor A. J. Kelly of McGill University, his subject being Geodesy and its relation to Astronomy.

Geodesy was differentiated from Plane Surveying by the need of taking into account the curvature of the earth when the area under consideration exceeds a few hundred square miles. The first essential is the determination of the true meridian. The surveyors' compass was first discussed with reference to corrections for declination due to secular variations of the magnetic north (approx. 2 centuries); annual and diurnal c variations (from 2′ to 15′, greater in summer than in winter); magnetic storms and auroral disturbances. The value of the compass for surveying standing timber was indicated.

True North may be obtained by observing the Culmination of Polaris. This resolves itself into the simple procedure of noting the bearing of Polaris when both it and Mizar (and Cassiopeia) are in alignment with a plumb line or vertical slit of a compass sight. Two things only must be remembered—that Lower Culmination of Polaris takes place at midnight on April 16, (hence Upper Culmination at midnight October 16), and that the time of culmination advances about 4 minutes per day.

The Transit Theodolite was next shown, and the determination of True North by observation of the Elongation of Polaris was explained. A third method is by means of observations of the altitude of the sun and the solution of a spherical triangle, but inaccuracies are introduced through the rapid change in solar

declination. This also affects the value of a method based upon observation of equal altitudes of the sun before and after midday.

The method of survey of the Dominion Crown Lands was carefully described. The 49th Parallel being taken as the 1st base, 2nd and 3rd, etc. bases were run at intervals of 24 miles 12 chains north, the latter being for Road Allowance. Chords 6 miles 6 chains were laid off along each base, and from the extremities of each chord true meridian lines were run 12 miles 6 chains north and the same distance south. There is of necessity a failure to meet owing to the convergence of the meridians, this overlap being termed the "jog", and is allowed for on correction lines, which run east and west midway between the bases. Each township is then divided into 36 sections by 5 meridians and 3 parallels, and one quarter section then has the area of 160 acres.

The Top and Side Auxiliary Mining Transit was shown and the elimination of errors by reversal explained. The transference of a surface bearing to an underground line can best be accomplished in the case of a single vertical shaft by means of two plumb lines. Special reference was made to the Michigan Tamarac Shaft 4,250 ft. deep and to the survey of the Mount Royal Tunnel.

Other instruments shown and discussed were the Photo Theodolite; the Altazimuth instrument reading to 1" of arc; the Zenith Telescope for determining latitude from observations on the positions of two stars of approximately equal and opposite zenith distances; the Field Transit for longitude observations on stars near the equator, their clock time of crossing the meridian being noted and compared with their tabulated times of transit.

Other methods for getting latitude were by observing Polaris at culmination and adding $\pm 1°06'$, its angular distance from the Pole; or by measuring with the Transit or the Sextant the altitude of the sun at apparent noon. This is the ordinary method of the navigator, but where there is no water horizon, an artificial horizon by the use of a dish of mercury is employed—in either case corrections for parallax and refraction are required.

After brief remarks by the chairman and vice-president, the very hearty thanks of the Society were given the lecturer and the meeting adjourned.

A. VIBERT DOUGLAS,
Secretary.

At Victoria

March 31.—The Society met in Victoria College at 8.00 p.m., The President, Mr. J. Duff, in the chair. The attendance was forty.

The minutes of the meeting of March 17 were read and confirmed.

Mrs. J. A. Pearce, 107 Cook St., Victoria, was elected a member.

The fourth lecture of the series on the Solar System was given by Mr. W. H. Christie, the subject being "The Four Planets, Mercury, Venus, The Earth and Mars."

Mr. Christie introduced his address by giving a review of the early conceptions of the solar system according to the views of Ptolemy, Copernicus and Tycho Brahe. The Laws of Kepler, the pupil of Brahe, were briefly discussed,

and illustrations were given of the third law which enables us to easily find the relative distances of the planets by determining their periods of revolution.

The apparent motions of the three planets as seen from the earth, the planetary configurations of elongation, conjunction, opposition, etc., were explained from blackboard diagrams.

The physical characteristics of the four inner planets were described in some detail, a recent photograph of Venus by Rordame, together with a drawing of some surface markings, were shown. A number of proofs of the earth's sphericity and rotation on its axis were given. The planet Mars was discussed at greater length, the interesting discoveries of Schiaparelli and Lowell, and the more recent work of Coblentz in determining the mean temperature of Mars (40 F.) were emphasized.

After the address the President referred briefly to some of his observations on the planet Mars, and a short discussion ensued.

A vote of thanks moved by Dr. J. S. Plaskett and seconded by T. J. McGill, was conveyed to Mr. Christie for his interesting lecture.

The meeting adjourned at 9.45 p.m.

April 14, 1925.—The Society met in the auditorium of the Girls' Central School at 8.00 p.m., the President, Mr. J. Duff in the chair.

The minutes of the meeting of March 31, were read and confirmed.

The fifth lecture of the series was given by J. A. Pearce, on the subject "Asteroids, Comets and Meteors". Commencing with Bode's Law 1772, which indicated the existence of an undiscovered planet between the orbits of Mars and Jupiter, the more important events connected with the early discoveries of the asteroids were related. The laborious visual method of detecting the small planets was replaced by the photographic method in 1891, by which means large numbers have been found yearly, there being over 1,100 thus far catalogued. Photographs of the images and trails of two of the asteroids discovered in 1922 were shown, and the method of measuring the plates and computing the elements of their orbits was explained. Following a brief description of the asteroid family reference was made to the importance of Eros, for by determining its distance from the earth we are able to fix a scale to the Solar System. Eros at its closest approach is about 13 million miles distant, much nearer than any other body, the moon of course, excepted.

The general appearance and characteristics of the comets as they move in their elongated ellipses about the sun were then discussed. A series of photographs of Halley's comet, taken on succeeding days during its last appearance in 1910, well illustrated the changes and modifications in structure that take place sometimes within a few hours. Reasons were given for regarding comets as true members of the solar system, and not as nomadic visitors from interstellar space. The disintegration of comets and the subsequent formation of meteor swarms travelling in the same orbit were described. The observations of meteor radiant points and the computation of their orbits definitely establish their relationship to the comets.

J. A. PEARCE,
Secretary.

April 28.—The Society met in Victoria College at 8.00 p.m., the President, Mr. J. Duff in the chair.

The minutes of the meeting of April 14, were read and confirmed.

At this meeting, the sixth and last lecture of the Solar System series, which has been presented by the Society during the winter, was given by the President on the subject, "Jupiter, Saturn, Uranus and Neptune."

Jupiter and Saturn being much nearer to us are visible to the naked eye and were known to the ancients; but vaster distances separate us from the two outer planets. By a simple application of Kepler's third law of Planetary Motion the speaker showed that the distances from the Sun to Uranus and to Neptune are 19 and 30 astronomical units respectively. (An astronomical unit is the distance between the Earth and the Sun).

Uranus which is invisible to the naked eye, was discovered in 1781 by William Herschel. This enthusiastic astronomer saw that the object had a noticeably disc-like appearance. Continued observation showed it to be in motion and its identity as a planet was soon established. The position of this body had been marked nineteen times before, and from the data thus already collected its orbit was computed.

How the slight irregularities observed in this orbit led to the great mathematical work of Adams and LeVerrier, and thence to the discovery of the planet Neptune in 1845, was then narrated. Little is actually known of the physical conditions of these two remote planets. There are indications of rapid rotation in the case of Uranus and both are believed to be in a gaseous state.

The fact that noticeable changes take place in Jupiter's belts and in the other surface markings indicates a gaseous condition on this planet, the density of which is known to be little more than that of water. Jupiter's family of nine moons was then described. The four bright ones were discovered in 1610 by Galileo. The speaker emphasized their importance in the determination of the mass of the planet through a knowledge of their periods of revolution. Several slides from photographs and drawings of Saturn were shown while the planet was being described. The reasons why the rings could not be solid were then discussed. Mathematical analysis shows that those parts of the ring nearer the planet must move with greater velocity than those parts more remote. Thus the rings could not exist in a solid state on account of the enormous strains to which they would be subjected. Observation with the spectroscope has shown that the innermost parts of the ring actually have a greater velocity than the outer parts, which is in keeping with the theory.

There seems to be little possibility of life on the outer planets. The two principal reasons for this conclusion are:

1. The planets are too far from the Sun to receive enough heat from this source to supply life.

2. It is true that heat is radiated from within the planets, but the period during which the surface temperature would be suitable to the maintenance of life would be too short for the evolution of human or any other form of life.

After some discussion on the lecture a hearty vote of thanks was returned to the speaker.

The meeting adjourned at 9.30 p.m.

H. W. BLACKETT,
Recorder.

AT TORONTO

May 19.—The regular meeting of the Society was held in the Physics Building at 8 p.m., Mr. A. F. Hunter in the chair.

Mr. N. H. Stovell of Hamilton, Ont., was elected to membership.

Miss E. M. Budd then read several extracts from interesting articles in the April magazines on Astronomy. One article expressed appreciation of the splendid work of the late Dr. Parkhurst of the Yerkes Observatory. A letter in the "English Mechanic" gave the decision by the governing bodies of various churches to agree to the change of Calendar fixing Easter on the second Sunday in April.

From an article by Dr. Louis Bauer was given a paragraph headed "Is the Sunspot Influence Direct or Indirect?" In an article in the Monthly Evening Sky Map is a description of the work of Jerome S. Ricard, S. J. who traces a connection between the sunspots and high and low areas of pressure on the Pacific coast from a study of the weather maps.

Mr. W. E. W. Jackson remarked that he would consider the information on the subject insufficient for such predictions.

Mr. Miller drew attention to the loss that astronomy had sustained in the death of Father Cortie of Stoneyhurst, England.

The speaker of the evening was Mr. J. R. Collins whose subject was "Ether Theories". Mr. Collins explained the necessity for the introduction of the idea of the ether in connection with the electro-magnetic and other theories dealing with the transmission of energy through space.

Scientists are still searching for a theory which will not assume the presence of the ether. Newton thought of it as a fine fluid pervading all space and it was later described as a solid or super-solid. Several theories have been propounded by Clerk Maxwell, Lord Kelvin, Planck, Einstein and others, assigning various properties to the ether. The speaker described these in detail, and mentioned the objections to the different theories.

The meeting adjourned at 10 p.m.

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